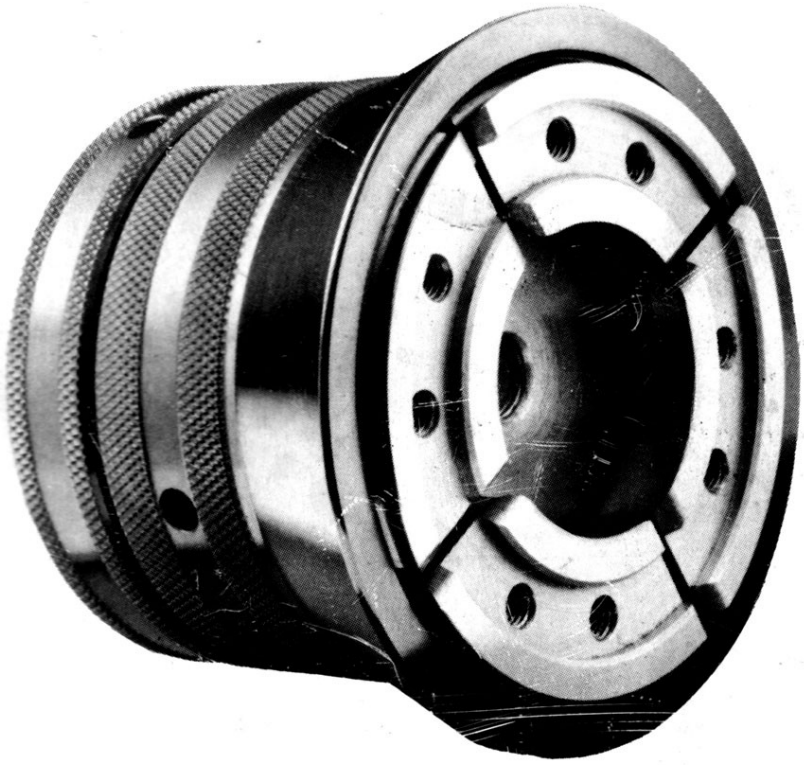

# THE MASTERCHUCK MANUAL

Henry Taylor Tools Ltd.

## INTRODUCTION

I have been designing and using woodturning chucks since 1972 when the Coil Chuck was conceived. Woodturning chucks have changed greatly since that time but their purpose remains the same. They all have to grip a piece of wood securely while it is being turned. The Masterchuck was designed as a multipurpose chuck capable of many different functions. The intention was to give the woodturner more freedom than ever before in selecting the way in which the workpiece is to be gripped and the size and shape of the gripped surface. The Masterchuck will perform all the functions of previous designs such as gripping into a recess in the base of a workpiece or gripping onto the outside of some form of spigot. It also provides a versatile base for mounting various useful accessories and new accessories are continuously being developed.

The main appeal of the new Masterchuck design is its ability to take wooden jaws which can be shaped by the user to fit whatever workpiece is to be turned. This new facility opens up new avenues of woodturning design as virtually any shape or size can be gripped, inside or outside. It is now feasible to make wooden jaws many times the size of the chuck itself to grip the outside of large objects such as bowls without leaving any fixing marks or recesses. It is equally easy to construct very small jaws from wood or hard plastic for gripping miniature turnings. The only limit to the uses of the new chuck is the ingenuity of the turner. I am sure that users of the Masterchuck will soon come up with new chucking techniques which were not even thought of when the chuck was designed. I would be interested and grateful if Masterchuck users were to write to me about any fresh ideas they might have, so that these ideas could be transmitted in the form of publications and even new accessories to the woodturning fraternity all over the world.

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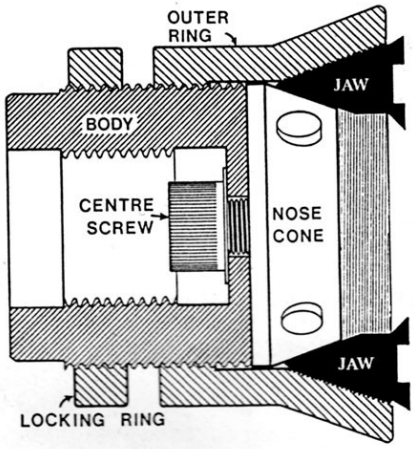



## TAKING THE CHUCK APART

The chuck is supplied assembled ready for use but it is a good idea to take it apart to become familiar with its operation. Before taking it apart remove the locking ring by unscrewing it from the back of the chuck. Open and close the jaws by turning the outer ring by hand. Note how the front faces of the jaws remain flat and flush with each other when the chuck is correctly assembled.

To take the chuck apart adjust the jaws approximately to the mid point of their travel. Place the chuck face down on a bench and loosen off the central bolt which can be seen by looking into the rear of the chuck body. Use the large hexagon wrench together with the small pin spanner. It is not necessary to remove the bolt completely, one turn is sufficient. Then pick up the chuck and hold it by the outer ring with one or two fingers over the jaws to prevent the jaws turning within the outer ring. Use the other hand to unscrew the body out from the back of the chuck by one or two turns. Pull out the jaws which will now be loose. The body can then be removed by screwing it forwards so that it comes out of the front of the outer ring. If the central bolt is removed entirely the centre boss and body will come apart.

## ASSEMBLING THE CHUCK

To reassemble, bolt the nosecone and body together but leave the bolt loose so the boss can turn easily. Screw on the outer ring from behind and position it so that the nosecone is about 1/4" behind the front edge of the ring.

The jaws are numbered clockwise 1 to 4. They must be put back in their correct order. The driving pins on the nosecone fit into the slots in the rear of the jaws. Place the jaws in position so that they are flush with one another. Hold the chuck by the outer ring face up in one hand with a finger on the jaws to prevent them turning. Sight across the top of the chuck to check that the jaws remain flush and use the other hand to screw the body up into the chuck. The jaws must not rotate while you are doing this. The nosecone will be pushed upwards so that it wedges the jaws slightly apart, seating them firmly into the threads in the outer ring. If you look at the space between the jaws you will see that the jaws move apart until they are fully seated when the body will turn no further. The jaw faces should now be perfectly flush with each other and there should be no slack in the jaws. Tug at each jaw to check this. If one jaw is tight and the others are loose unscrew the body 1/2 turn and repeat. If the jaws refuse to seat properly there may be some dirt in the threads.

When you are sure that the jaws are seated properly in their threads unscrew the body a small amount to give the chuck some working clearance so that it can operate easily without binding. This small amount should be about 1/2" of the circumference of the body which corresponds to 1/12th of a turn. If you watch the pin spanner hole in the body move as you screw the body back you can gauge the correct amount by sight. When you have set the working clearance tighten the centre bolt firmly using the large hexagon wrench and the small pin spanner.

ASSEMBLY continued

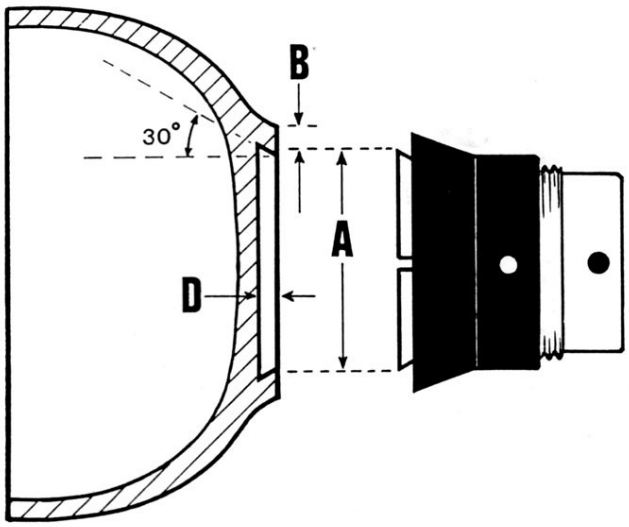
Operate the chuck by hand from fully open to fully closed. It should not bind and the jaws should not be too loose. 'Too loose' means more than about 1/32" radial movement in any jaw. It is desirable to minimise the working clearance to minimise the slack in the jaws but if there is not enough working clearance the chuck may bind at the extremes of its movement. Practice the procedure until you are fully familiar with it. When the chuck has been used a few times it will 'run in' and work with less clearance. Always try to minimise the working clearance to make the chuck as rigid and accurate as possible.

IT IS VERY IMPORTANT to realise that, if there is excessive working clearance in the mechanism, the jaws will only be held by the tips of their threads and the chuck will not be safe in expansion mode. The chuck is always safe in compression mode because the jaws are forced hard into the threads by the gripping forces.

Once the chuck has been correctly set up it is seldom necessary to take it apart again. Extension jaws can be changed without disassembly and without even removing the chuck from the lathe.

HINT FOR FIRST TIME USERS

If the chuck is temporarily put together with one jaw missing it is possible to see into the internal mechanism while it is working to gain a full understanding of how it works and how best it can be used for your own application.



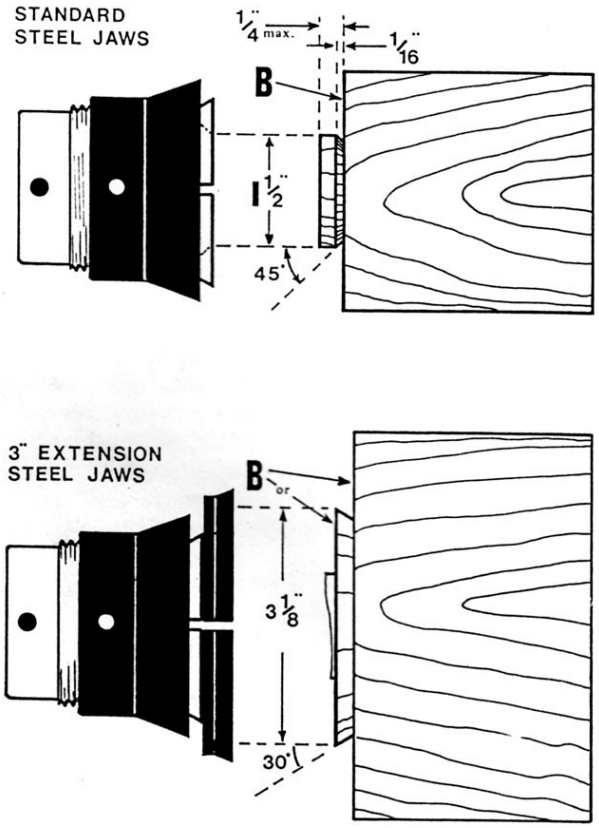

| EXAMPLES | A | B | D |
|---|---|---|---|
| Bowl 6" x 2" Standard steel jaws | 2,3/4" | 3/8" min. | 1/8" |
| Bowl 10" x 3" Standard steel jaws | 2,3/4" | 1/2" min. | 1/8" |
| Large bowl 14" x 4" 3" extension jaws | 3,5/8" | 3/4" min. | 3/16" |
| Small bowl 4" x 3" 1,1/4" ext. jaws | 1,1/2" | 3/16 min. | 1/16" min. |

## GRIPPING INSIDE A RECESS

Hold the wood blank on the lathe using screwchuck faceplate or pinchuck and turn the base flat. Turn a recess in the base to match the jaw outer diameter measured when the chuck is in its closed position. Use the point of a skew scraper with the tool rest at centre height to undercut the recess to give a dovetail shape as shown. Test to see if the chuck will fit securely. Smooth the bottom of the recess and preferably turn and finish the base of the bowl. It is possible as an alternative to turn the base of the bowl while it is on the chuck but it is difficult to polish the wood evenly right up to the chuck jaws.

The recess must be deep enough to hold the bowl securely. The depth (D) required depends on the hardness and strength of the wood, the weight of the workpiece and also on the degree of unbalance. The skill of the turner in being able to complete the work without digging in is also important. If in doubt use the deepest possible recess. There must be sufficient wood (B) around the recess for strength.

The locking ring is not normally used when gripping internally. Fit the chuck to the lathe and hold the wood blank firmly onto the jaws, ensuring that all the jaws go fully into the recess, and tighten up by hand. Spin the wood blank by hand to make sure that the turned area around the recess runs true. If not, the jaws have not been pushed fully home before tightening so repeat. Use the pin spanners to firmly tighten the chuck. Check that the blank is secure by attempting to pull it off the chuck by hand. Spin it by hand to check that it runs true before starting up.




## GRIPPING A SPIGOT FOR TURNING CYLINDERS

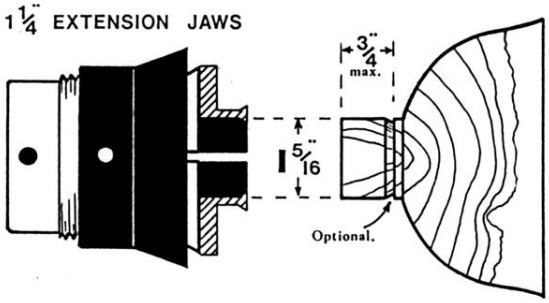
Prepare the wood between centres on the lathe with a spigot at the end shaped as shown. The spigot should just be able to pass into the jaws when the chuck is opened. When the chuck jaws are closed onto the spigot the face at (B) should be drawn up hard against the face of the jaws to provide support and rigidity. The face at (B) should be flat or slightly concave to ensure this.

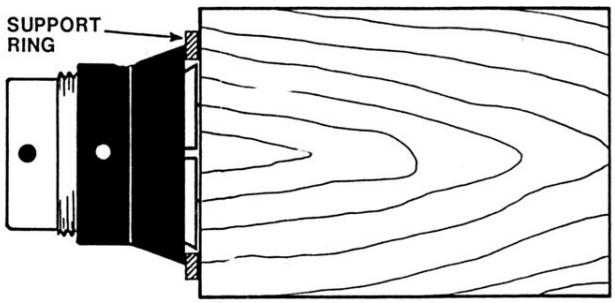
LOCKING RING

It will be found that even when the chuck is fully tightened you will be able to feel a slight movement due to the working clearance between the jaws and the nosecone. This can be eliminated by using the locking ring to hold the outer ring solid to the body.

For all external gripping operations the centre bolt must be extra tight. The chuck can be tightened onto the spigot while the chuck is on the lathe. The locking ring should be loosely attached to the rear of the chuck while you are doing this. Use the two C spanners together for leverage. The locking ring is then tightened hard up against the outer ring, again using the C spanners, to make the chuck rigid. Before starting up check by hand that the workpiece runs true and is secure.

If the chuck suddenly becomes loose while you are tightening, you did not have the centre bolt tight enough initially. The remedy is to remove the chuck from the lathe, reset the working clearance, firmly tighten the centre bolt, and start again.




AN ALTERNATIVE TO THE LOCKING RING

The chuck can be made solid without the use of the locking ring by reducing the working clearance to zero. This method gives even more accurate running for external gripping but is slightly more involved.

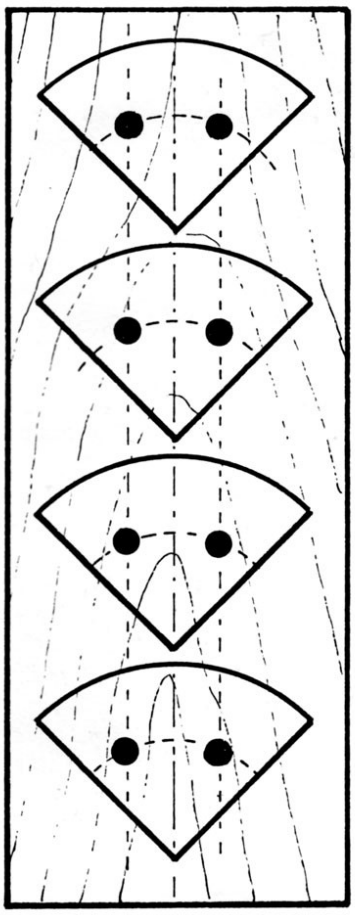
Hold the workpiece in a vice so that the spigot is uppermost. Make sure that the centre bolt is firmly tightened and place the chuck over the spigot. Tighten the jaws onto the spigot whilst pushing down on the chuck to make sure it tightens hard up against the rear face of the cylinder (B). Use the pin spanners to tighten the chuck fully. When the chuck is tight onto the spigot, loosen the centre bolt. Use the small pin spanner to turn the body clockwise into the chuck until it is tight. Re-tighten the bolt. This procedure reduces the working clearance to zero and makes the chuck absolutely solid. It can then be screwed on to the lathe and checked by hand for security and true running before starting the lathe. The working clearance must be reset before the spigot can be released.

USING A SUPPORT RING Large cylinders need extra support for rigidity. This can easily be provided by means of a large washer fitted between the front edge of the outer ring and the rear face of the workpiece. As the chuck is tightened onto the workpiece the rear face is drawn hard up against the washer giving extra support. Support rings can be quickly turned from wood as required. It is a good idea to have two or three of different thicknesses. To determine the thickness required use the chuck to grip the workpiece without the support ring and choose a support ring just thicker than the gap between the outer ring and the rear face of the workpiece. The best way to grip large cylinders without bothering with support rings is to use the large bolt on steel jaw set which gives a very secure grip.

## WOOD JAWS. GENERAL DISCUSSION

The Masterchuck has been specially designed so that wood or plastic jaws can be firmly attached and turned to shape in situ. The chuck has the unique feature of being able to be locked solid so that the jaws stay rigidly in position while they are shaped. The chuck is locked by reducing the working clearances inside the mechanism to zero.

The jaws are usually made from wood blocks which are drilled to take high tensile fixing screws and are thus fixed to the front face of the standard steel jaws. The chuck is then locked solid, fitted to the lathe, and the jaws shaped using normal woodturning methods. A wide variety of wooden jaws can be made of all different shapes and sizes. They can grip outside or inside or both. They can be quickly screwed onto the chuck when required without dismantling the chuck. They can be easily modified when required or trued up. Because they are turned in situ with the chuck attached to the lathe they will run dead true. In fact, using jaws trued up in this way results in the most accurate gripping method known. In precision engineering, metal turners often turn up what they call soft jaws (in steel) to grip a job which is required to run true. They expect to achieve a maximum runout of less than one thousanth of an inch and there is no reason why woodturners should not get close to this order of accuracy using soft jaws on the Masterchuck. It would be reasonable to expect an accuracy of 0.005" or better using wood jaws provided they are trued up just before use to eliminate inaccuracy caused by the wood warping. Even better accuracy can be maintained using hard plastic as the jaw material. Special hard, tough and impact resistant plastic laminates are available and are ideal for this purpose. They are resistant to wear and do not warp so are worth the trouble making for a small production run in the professional turners workshop. The effect of wooden jaws warping can be minimised and the strength of the jaws improved if the grain of the wood is orientated to run radially. This means that the jaws should be cut individually from a plank of wood rather than from a disc of wood cut into four. Simply cutting a disc into four however, is a simple and quick method and works well for a one off job which does not require ultimate strength. Plywood is a good jaw material and very convenient to use. Good quality high density ply should be selected.

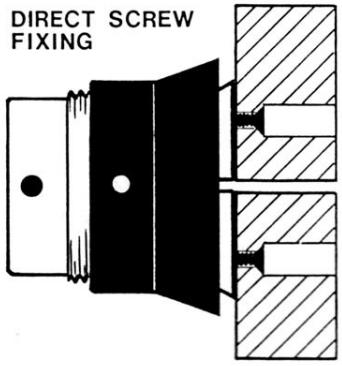


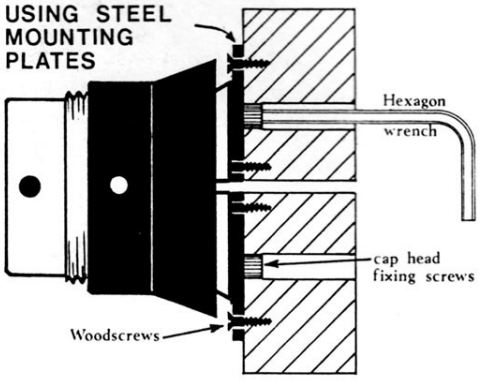
## MAKING WOODEN JAWS

The diagram opposite shows a small plank of wood with four jaw blanks marked out and drilled ready for cutting out. Note that the grain direction will be radial when on the chuck. The length, width and thickness depends on the size of wood jaws required. Any hardwood will do but it must be free from defects and as hard and close grained as possible. The jaw blanks are marked out with ruler and compasses and the marking out lines are shown dotted. Two lines determine the distance apart of the holes which is 0.545". The radii of the compass arcs for the hole centres are 1.05". Marking out is easy if you have a set of metal jaw fixing plates. Just screw them to the plank of wood and draw round them. Then leave them in position and use a 3/16" drill to drill the fixing holes using the metal plates as drill guide bushes.

## LOCKING THE CHUCK SOLID FOR SHAPING WOOD JAWS

To enable accurate shaping of the wood jaws it is important to eliminate any movement in the jaws while they are being turned. To lock the chuck loosen the centre bolt. Use the small pin spanner to screw the body into the back of the chuck as far as it will go. Tighten the centre bolt and check that the jaws are now rigid.



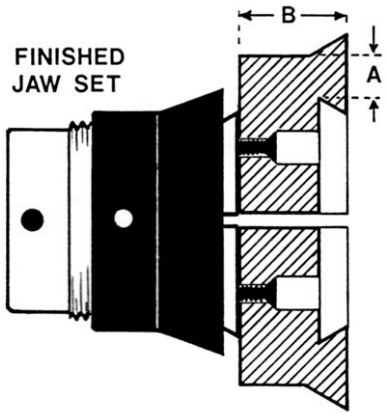

## FIXING WOODEN JAWS

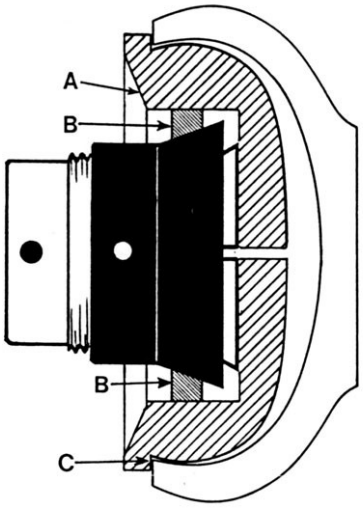
The jaw blanks can be fitted direct to the standard jaws using countersunk head screws and this method is quick and easy. The screws are 3/16" B.S.F. preferably high tensile hexagon socket screws. See spares list. It is necessary to turn the plank over and open up the hole (11/32" drill) part way down to allow the head of the screw to sink well below the jaw surface. Otherwise you would not be able to shape the jaws. You may find it necessary to open up the remainder of the hole to 13/64" so that the screw is easy to insert. When you cut out the jaw blanks cut 1/16" inside the two straight lines to allow the steel chuck jaws to fully close. Adjust the chuck to the mid-way position and lock it solid by reducing the working clearance to zero (see page 10). Fit the chuck to the lathe. Mark the jaws 1 to 4 and fit them to the corresponding steel jaws in the chuck. The wood jaws can then be turned to shape using normal woodturning methods.

## METAL FIXING PLATES.

Metal fixing plates are available which can be mounted permanently to the wood jaws using wood screws. The fixing plates locate accurately to the jaws of the chuck and are held on using high tensile cap head screws supplied with the plates. They give a stronger and more reliable mounting for the wood and they are also useful as drilling templates when drilling fixing holes in the jaw blanks.

Make four jaws as described on page 10 except that the holes for the cap head screws are drilled out all the way through so as to be a tight fit on the cylindrical head of the screw. The screw heads can then accurately locate the wood jaw to the plate and provide extra strength and support. Remember to mark the wood jaws 1 to 4 to correspond to the steel jaws. Screw the plate to the wood jaws using size 4 or 6 screws. which must not be too long or you will turn into them when you shape the jaws. Fit the wood jaw & plate assemblies to the chuck and shape the jaws using normal woodturning methods. If the positions of the woodscrews are a problem the mounting plates can be drilled with holes in different positions.




## IMPROVING THE GRIP OF WOODEN JAWS

There is no limit on the size or shape of wooden jaws which can be made but it is always a good idea to turn a dovetail or hooked shape on the edge of the jaws or to use some shape which gives positive location of the workpiece rather than a friction grip. If you have to use a friction grip use a large area of contact. In the case of the dual grip (internal and external grip) jaws shown at top left, the angle of the dovetail shape is about 30 degrees from the horizontal. Ensure that the thickness at A is not so small that the jaws can break off in use. The amount that the jaws project from the chuck (B) should be the minimum possible to achieve the best gripping force. The jaws shown at left could be improved in this respect. A general rule in all chucking work is to try to keep the workpiece as close as possible to the bearings of the lathe i.e. minimise the overhang. If the overhang is too great the leverage on the gripping location may cause the workpiece to shift if the tool digs in. Excessive overhang reduces rigidity and causes vibration problems with a consequently poor turned finish. If it is possible to enclose the chuck with a hollow workpiece it is worth doing.

The diagram at bottom left shows a bowl gripped on the inside by wooden jaws which partly enclose the chuck, thus reducing overhang. Note the cut away angle at A which allows access for the C spanner. The shoulder at C gives support and aids true running. Small blocks of wood at (B), one for each jaw, can be glued to the wood jaws after screwing them on. Use quick set epoxy or hot melt glue. They are positioned so that they bear on the smooth surface of the outer ring and give extra support and rigidity. They are only needed for large work.

If you want to grip inside a rough turned bowl in order to prepare its base it is helpful to tap in some panel pins around the periphery of the wooden jaws and cut the heads off to leave them protruding 1/8" or so to give better grip inside the bowl. Another way to improve the grip is to glue a layer of abrasive grit to the surface of the jaws. Avoid putting wax polish on the surfaces to be gripped as this reduces the friction.

SCREWCHUCK ACCESSORY

To fit the screwchuck you do not need to take the chuck apart. Remove the centre bolt without disturbing the relationship between the body and jaws and outer ring. Replace it with the machined woodscrew and tighten firmly. Check by tugging at the jaws that you have not altered the working clearance of the chuck. If you have you can reset it in the normal way.

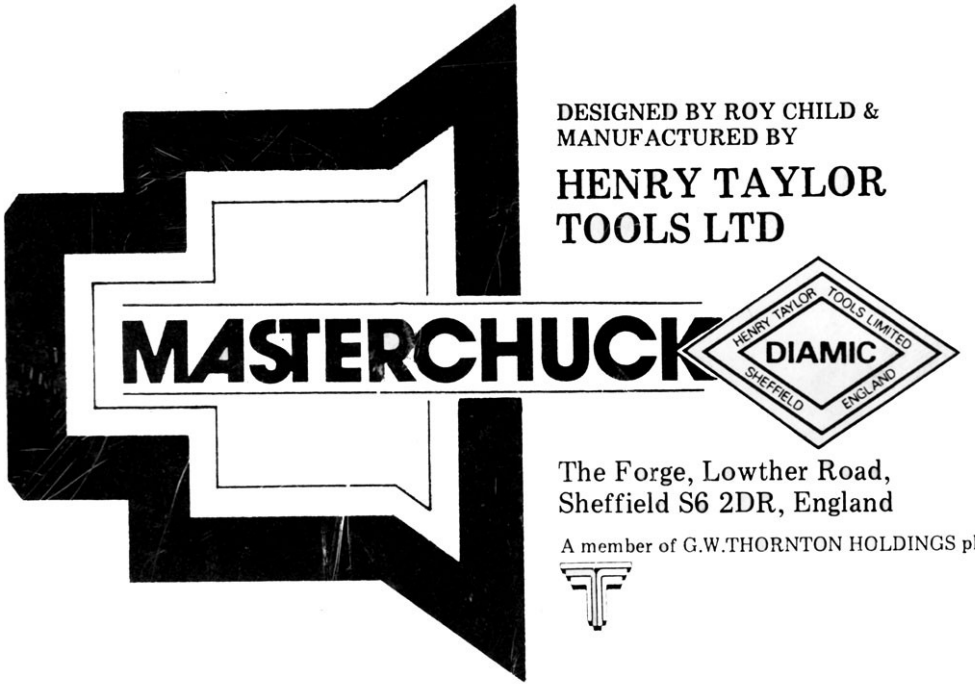
To use the screwchuck drill a 1/4" pilot hole for the screw in the centre of the wood blank. The jaws of the chuck can be advanced by operating the chuck and the length of screw exposed can be adjusted. The workpiece can be simply screwed onto the screw until it comes up hard against the jaws. Extra support for the work can be obtained by tightening the chuck so that the jaws push hard against the rear of the wood blank.

If the pilot hole has been drilled right through the wood blank the workpiece can be removed and reversed to turn the other side. This is very useful for turning toy wheels etc.

PINCHUCK ACCESSORY

The pinchuck grips inside a hole drilled into the workpiece. The pinchuck is bolted onto the body of the chuck using the central bolt. To fit it take the chuck apart completely and use only the body, central bolt & washer, and the pinchuck.

The hole for the pinchuck must be accurately drilled to size. A sawtooth forstner bit is recommended for this. The pin chuck is held horizontal with the small pin positioned in the centre of the milled flat. The workpiece is pushed onto the pinchuck and twisted to lock. The small pin will roll to one side and jam in the hole thus locking the workpiece securely in position. Twist the other way to unlock. It is useful for any workpiece of irregular or awkward shape which cannot be gripped any other way.

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